THAT NEW BRIDGE.

The Proposed Structure Across the Trinity River.

THE OPINIONS OF ENGINEERS.

What Experts Think of the Plans and Specifications — The Theories Advanced on Each Side Regarding the Merits of the Plans.

There has been considerable talk regarding the proposed Eddy suspension bridge across the Trinity river, and there being a wide difference of opinion about the [illegible] and assertions having been freely [illegible] by both sides to the controversy, THE GAZETTE this morning presents the opinions of expert engineers consulted, and which are now on file with the council, without comment.

At the last meeting of the council the street and alley committee reported recommending the bridge to be built according to the approved plans and specifications submitted by Johnson & Flad.

REPORT.

NEW YORK, Sept. 28, 1891.

H. H. Kerr, Esq., Fort Worth, Tex.

DEAR SIR—I have carefully examined the drawings and specifications of the "proposed Trinity river (suspension) bridge" at Fort Worth, and in accordance with the request of the city council I would respectfully report as follows:

First as to the specifications. These are [illegible] such as are ordinarily presented in good engineering practice. The [illegible] of the roadways is mentioned [illegible] pounds, and of the sidewalk as [illegible] pounds per square foot, with a factor of [illegible]; but no mention of the dead [illegible] or strain sheet is given (and [illegible] always accompany a design), [illegible] over the entire computation, [illegible] to tell whether the sizes [illegible] correct. Aside from this there is [illegible] for disputes to arise as to the [illegible] of the clause in question. [illegible] is required to have a resistance [illegible] five times the tension on the [illegible] when fully loaded. The amount [illegible] is nowhere shown.

[illegible] ties, etc., are required to be of [illegible] parallel wires, and wrapped for [illegible] of three inches with fine wire at intervals [illegible] twenty inches. This [illegible] provision to allow the water [illegible] to penetrate to the interior of the [illegible] and ultimately to destroy [illegible]. This is not theory, but has been [illegible] by actual trial. Aside from [illegible] with one great advantage [illegible] wrapping under heavy pressure [illegible] binding of the individual [illegible] that they act as one, the [illegible] wire against adjacent wires [illegible] when a cable is properly [illegible] is fully equal its tensile strength [illegible] length of some fifteen feet.

[illegible] clause, asphaltum paint is [illegible] as a preservative. This is not [illegible] in such cases.

[illegible] shown of fastening the [illegible] and diagonals, allows [illegible] adjustment of lengths; and it is absolutely certain that at some [illegible] will either be subjected to abnormal strains, or will not perform the full [illegible] of them.

[illegible] for the hand rail are specified [illegible] one-half inch round iron. When [illegible] thread is cut on this it will be still [illegible], and the use of such small [illegible] is not good practice, as aside from [illegible] of strength, they are not [illegible].

No bonding or sizes of stones are mentioned in the description of the masonry. [illegible] walls are mentioned but no [illegible] description is given.

The towers are each to rest on a circular [illegible] bed plate. These to be of use [illegible] strong enough to transmit the pressure equally over their entire surface, [illegible] as shown they have no stiffening ribs, [illegible] are not safe against rupture. The central towers are larger than the others and carry more load, but the bed plates are [illegible] to be of the same dimensions [illegible].

A cast-iron cap is provided for the top of each tower as a bearing for the cable at that point, but no dimensions are given.

The adjustment for the wind brace [illegible] a very crude device.

The provision for "two coats of paint" [illegible], with no specification as to quality, is not a proper specification, neither [illegible] quantity sufficient.

The [illegible] given for a test, viz: that the bridge shows "no undue distortion," etc., is vague, and subject to criticism. [illegible] is "undue distortion, etc.?" Who shall decide?

As I understand the last clause in the specifications, each main cable has two auxiliary cables. Starting from the anchorage on one side, the course of a cable is as follows: It runs over the top of the next [illegible] tower, serving to act as a back stay. It then curves down to the center of the [illegible] span and crosses a similar auxiliary from the opposite anchorage and is wrapped tightly to it, although the [illegible] of this wrapping may be questioned. From this point it continues [illegible] underneath the floor timbers, passes through a hole in the tower on the opposite side from whence [illegible] started and thence underneath the floor timbers of that side [illegible] to the anchorage. Passing from the [illegible] this brings up one of the main [illegible] in the proposed structure. The [illegible] have alternate suspenders attached to them, and in addition, diagonals [illegible] change of form under partial [illegible]. The auxiliaries have the remainder or one-half of the suspenders attached. In other words, a cable of less than one-[illegible] the size has one-half the load transmitted to it. Aside from this, the auxiliaries [illegible] diagonals attached, and any one who has ever seen a carpet shaken, [illegible] these cables will change form [illegible] under very light loads. They [illegible] properly under a uniform load over the whole bridge. The result will be that the main and auxiliary cables cannot work together, the smaller will yield by [illegible] and practically, the load from the [illegible] cables will at all times be thrown [illegible] cables.

Another [illegible] feature of this design is, that the auxiliary passes between the diagonals and the suspenders to the main cables [illegible] as bent to one side to prevent [illegible], although it will not prevent [illegible]. The constant change of form will [illegible] chafing at every intersection, and the wear will soon destroy the strength of the suspenders, as well as weaken the cable.

The employment of the auxiliaries as a means of attachment of the lower ends of [illegible] is very unusual, and a very [illegible] device. It would seem as [illegible] the whole arrangement was introduced for the purpose of novelty. No mechanic would ever use a bundle of wires as a support to a transverse load if he could [illegible] rod or some still better form for [illegible] that the rod is not only greatly [illegible], but cheaper.

The [illegible] angle at which the diagonals are attached to the cables renders it almost [illegible] there will be occasional slip[illegible] and they cannot be depended upon to [illegible] certainty under very heavy loads—[illegible] when they will be most needed.

[illegible] stays are shown, running from the tops of the towers to the roadway. These are presumably to aid in stiffening the floor against undulations, and also to bear a part of the load. The angles of these with the floor vary greatly, so that the strain in those attached farthest from the tower would, for a given load, be much the greatest, but they are all shown of the same size, viz: twenty feet each.

These are some of the crucial points in which the design is unsound. In the way of general criticism I will add as follows:

1. No design is good in which there is an ambiguity in the strains developed; and it would be impracticable to say just how any load will be transmitted through the members of this bridge to the supporting points.

2. The design, if well carried out, will be needlessly expensive. Just as much masonry is required under the towers as would be for any form of truss bridge; and the anchorages have to be built in addition. There are many reputable bridge concerns which will contract to erect a substantial truss bridge on any of the approved and well known designs, which will be more durable and less expensive for maintenance than this, and for the same strength less expensive.

It is now well recognized in the profession that suspension bridges are to be chosen as a rule only where great length is required, or where some other special circumstance render them desirable. Such is not the case at this point.

Finally the absence of any strain sheet makes it impracticable to institute exact comparisons between the proposed design and others, but I consider the design to lack so thoroughly in all the elements which go to make up a sound and lasting work, that I have no hesitation in condemning it absolutely. Respectfully submitted,

[Signed] F. COLLINGWOOD,
M. Am. Soc. C. E.

AMERICAN SOCIETY OF CIVIL ENGINEERS,
127 EAST TWENTY-THIRD STREET,
NEW YORK, Sept. 29, 1891.

H. H. Kerr, Esq., City Engineer, Fort Worth.

DEAR SIR—I inclose herewith my report on the plans and specifications sent by you for a suspension bridge in Fort Worth across Trinity river. After writing it, to see how it would seem to another bridge engineer, I submitted it to a friend, and he simply remarked, "You have not said half enough, as the plan is insufferably bad." I thought it best to point out the salient defects, and go no further.

I never saw the design before; but it is one of many made manifestly by a man without training as an engineer; and is well calculated to please the fancy of a body of laymen.

What I mean in the report by saying that suspension bridges are not chosen now for short spans, is this: Wherever the anchorages have to be artificial, the extra masonry on short spans is a very large item of cost. Then again, it is difficult to make short spans stiff enough, as the dead load and light load are too nearly alike for inertia to bear an important part, and when you come to add stiffening trusses, the cost is greatly increased. As an example, the Allegheny suspension bridge at Pittsburg is just now being removed, after some forty years service, to give place to a modern type of truss bridge. The suspension bridge is strong enough, but the vibrations under rapid movement of loads is very unpleasant, and might become dangerous. This had stiffening trusses, but they were not deep enough to be thoroughly effective. In the example before us there is an effort to make the main cables and auxiliaries perform this office, but it is not well carried out, and is destined to failure.

When there are so many well tried designs to be had, there is no excuse for seeking novelty. If it must be done, it should certainly be under the guidance and control of a trained engineer.

No engineer is provided for in the specifications, and it would seem that his presence would not be welcome.

I ought to add in reference to the strain sheet so conspicuously absent, that I really would hardly know how to undertake to make one. Yours truly,

[Signed.] F. COLLINGWOOD.

AMERICAN SOCIETY OF CIVIL ENGINEERS,
127 EAST TWENTY-THIRD STREET,
NEW YORK, Oct. 1, 1891.

H. H. Kerr, Esq., City Engineer, Fort Worth.

DEAR SIR—In the multiplicity of calls upon me during the past few days, I neglected to mention in my report (except incidentally) that no inspection of any kind is provided for in the specifications, and no person named who is to decide any questions which may arise.

Also that the description of the steel wire is such, that the most brittle wire procurable would comply with the requirements, provided it had the strength.

This is a very important matter. On the East River bridge it was only by the utmost watchfulness that we prevented the contractor for the wire from furnishing surreptitiously an exceedingly poor quality of wire. Yours truly,

[Signed] F. COLLINGWOOD.

FORT WORTH, Oct. 5, 1891.

To the Hon. Mayor and Council, city of Fort Worth.

GENTLEMEN—I beg leave to submit the following criticism on Mr. Collingwood's so-called report on the plans and specifications for the proposed Trinity river bridge.

First, he states that it is "impossible to tell whether the sizes given in the plans are correct without going through the entire computation." Now, supposing the strains had been given, would it not have been Mr. C.'s duty to have verified the calculations? All of the data necessary to make such computation is embodied in the plans and specifications submitted, and it was certainly incumbent on him to make them, and if Mr. C. has not made the calculations necessary to determine the strength of every part of the structure, on his own responsibility, whether I have supplied him with figures on this point or not, he has not done what was properly to be expected of him, and what he would be entitled to pay for. And in the absence of the necessary computation as to the correctness of sizes, etc., any observations which he has made as to the merit of the plans is gratuitous and unfounded assertion. It is legitimate to conclude that an engineer will back his opinions with figures, and his failure to do so is tantamount to an admission of inability to produce the proof.

2. His remarks relative to the tension of the backstays are subject to the same criticism involved in his failing to make computation on the strength of the members of the proposed structure. The tension of the backstays is given. Mr. C. knows, or ought to know, as well as I do, that in this case the tension on the backstays is the same as the tension on the main cables at the towers.

3. The remarks in regard to wrapping the cable entirely are entitled to more consideration than all the rest of this so-called report combined, though the manner of wrapping specified is the same as that of a suspension bridge across the Schuylkill at Philadelphia built in 1842, and which I believe is still in service, the only repairs to which have been the renewal of the floor and other woodwork and an occasional application of paint.

4. Asphaltum is mentioned as a preservative to be used only when the backstays come in contact with the earth, and in that way is the best preservative known, notwithstanding Mr. C's. assertion to the contrary.

5. The manner of fastening does admit of the proper adjustment of the suspenders and diagonals.

6. The tie-rods for the hand-rail can be increased to five-eighths or three-quarters iron if deemed necessary.

7. The tickness of the courses of stone in the masonry is shown approximately in the drawing, and as bounding is always considered necessary and essential in this class of work it was not necessary to mention it in the specifications. The retaining walls are simply to hold a bank of earth five to six feet high, and minute specifications are not necessary. The thickness of the walls shown in drawing is sufficient.

8. The cast-iron bed plates are to be two inches thick where the towers rest, and taper to three-quarter inches at outer edge. As it would be impossible to fit a twenty-four inch column to a bed plate calculated for a nineteen-inch column, it follows that the bed plates must vary in proportion to the size of the column.

9. The drawings are made to a scale, and the necessary proceeding to determine the size of the cast-iron caps was merely to apply a rule. If Mr. C. did not know this, whose fault is it?

10. The adjustment for the wind-brace cables may, in the opinion of Mr. C., be a crude device, but the pertinent question is whether it is sufficient for the purpose intended or not, and if it is not, why didn't he say so and why?

11. Has this city, or county, ever had a bride painted under any more definite specifications than two coats of good paint? And if this is not sufficient, how much would be?

12. As to the matter of "undue distortion," Mr. C. does not essay to offer advice, but as no pay is asked until completion in accordance with the specification and plans, the council can certainly find a reliable method of determining this question to their own satisfaction before payment.

13. Mr. C. first says that the arrangement of the suspenders puts one-half of the load on the auxiliary cables, and then in the next breath says that at times all of the load from the smaller cables will be thrown on the main cables. All engineers of experience in designing or constructing suspension bridges are agreed that where two or more cables are used in the design, the load will be distributed to each of them in proportion to their strength, "it simply resulting that where we have two cables to carry a load, and one is seven times as large as the other, then it is seven times as strong or rigid, and will consequently carry seven-eighths of the load, and the smaller one one-eighth of the load. This is a principle in the application of mechanics of absolute application. In as flexible a system as a suspension bridge the accuracy of the adjustment of the various members is only of minor importance," and no absolute nicety is essential in the distribution of the suspenders.

14. Nearly all suspension bridges have two or more cables, one above the other. In such case it is necessary that the suspender from the upper cable should come in contact with the lower cable, to prevent injury to either cable or suspender; it is provided in our specifications that each is to be wrapped at the points of contact. Should there be chafing, as Mr. C. fears, the wrapping would bear the injury, and could be renewed when necessary, but we do not think this would ever be found necessary, as no such experience has ever been known.

15. The attachment of the suspenders to the lower auxiliary cables may be novel and unusual, but that is no ground for condemnation. That an iron rod of the same weight of metal would be stronger is denied, and I challenge authority for the statement. That it would be cheaper cuts no figure in this case. The auxiliary cables perform various and sundry offices besides being used to attach suspenders to, among which may be mentioned their adaptation to assisting in staying the bridge against vibrations from traffic, also in staying it from under pressure from wind or flood, all of which seems to have entirely escaped the notice of Mr. C.

16. Any movement of the diagonals at the point of attachment to the main cables is impossible, without also moving out of place the adjoining diagonal, which a reference to the drawing will show is strained in the opposite direction, and also the main suspender as well, all being joined in attachment at the same point. The manner of fastening specified has been employed by Mr. Roebling in all his bridges, and none of them have ever slipped.

17. The long stays referred to are to stiffen the bridge against distortion. As Mr. C. fails to say whether any one has sufficient strength or not, it must be presumed that any one is equal to the greatest strain, and if, however, this is important, the number of wires in those next to the towers can be reduced.

If the strain can be calculated on any suspension bridge, they can be on this bridge, as the design in no essential feature differs from that of ordinary suspension bridges, the only changes introduced being such as are intended to stiffen the structure and prevent undue distortion to the floor, and as a stay against wind and flood.

I do not understand that Mr. C. was asked to comment on this form of bridge as compared to that of a truss bridge, and it is significant of his position that he takes occasion to indirectly recommend an iron truss in the place of a bridge of the design submitted.

Further, he says that an iron truss would be less expensive. Either he is mistaken on this point or the representatives of the iron bridge companies in Texas have attempted to get a vastly greater sum than their bridges are worth, as they all had an opportunity to bid on this bridge, and failed by a large amount to submit figures anywhere near the sum asked for a bridge of the size of the design in controversy.

It will be noticed that Mr. C. fails to make any comment whatever on the strength of the cable, the sufficiency of the towers, foundations, anchorage, or floor, all of which are the vital features of the structure.

As it is perfectly evident, from the general tone, and from the attempt to argue for an iron bridge in Mr. C.'s effusion, the plans submitted were manifestly tried and condemned solely in the attempted interest of the iron bridge companies, in advance, perhaps, even of their arrival in New York, and that the plans and specications were examined with the single object of finding ground on which to condemn, it can fairly be presumed that the floor, towers, cables, foundations and anchorage could not be successfully assailed. If they could have been, it would not have been found necessary to resort to criticisms of the specifications for "paint" and "bond in masonry," etc., for ground on which to base his condemnation.

It will be noticed that there is a wide difference between Mr. Kerr's report of three or four weeks ago and Mr. Collingwood's report.

Mr. Kerr said that the cables were not sufficient. Mr. Collingwood, by his silence on that point, says they are, and condemns only on account of the specifications for wrapping. Mr. Kerr said the towers were not strong enough. Mr. C. has nothing to say about the towers, but wants ribs in the bed plates.

Mr. Kerr said that "the anchorage is reckless." Mr. C. avoids making any comment on that point by saying that he does not know what the strain on the backstays is.

Mr. Kerr condemned the floor system. Mr. C. did not feel like commenting on the floor system, but says "the adjustment for the wind brace cables is a crude device," and so on. I will add that if Mr. C. is unable to calculate the strains in our bridge as he states, how can he consistently offer an opinion at all?

The iron bridge companies are fighting the wire bridges with all the weapons they can obtain, because it is manifestly to their interest to do so. That is all right, and fair enough for them, but I would suggest that a photograph of the King iron truss bridge that fell into the Colorado river at Austin, or that of another bridge by the same company that recently fell from its own weight into the Canadian river in the Panhandle, or of the North Side bridge when propped up, would be as ornamental to the city engineer's office as the one now on exhibition of the alleged failure of a wire bridge in California. Respectfully yours,

I. C. TERRY, C. E.

FORT WORTH, TEX., Oct. 6, 1891.

To the Honorable Mayor and City Council.

GENTLEMEN—Inclosed please find a printed copy of the communication of F. Collingwood, to whom Mr. Kerr, on your order at his request, submitted the plans of the proposed Trinity river bridge for an opinion on their sufficiency, and in connection and attached to it a review of the same by our engineer, which will speak for itself. We have joined the two together for convenience of the council in referring to both.

We beg to call your attention to the fact that Mr. C.'s communication does not even approach the dignity of an opinion, inasmuch as he disqualifies his entire statement at the outset with the announcement that "without going over the entire computation, it is impossible to tell whether the sizes given are correct." This refers to the sizes of the constituent members of the proposed structure. Without a calculation any statement vouchsafed in the premises is mere unfounded assertion. We cannot comprehend how he could essay, as an engineer, to offer a conclusion without first rigidly calculating the strength of the various sections and of the structure as a whole. It certainly cannot avail him to complain of the absence of a strain sheet as an excuse. He knows, or ought to know, if universal engineering authority is of any value, that as full a statement of strains is given in the plans as is necessary or usual in the case of suspension bridges, and even were this not the case, it would still afford him no excuse for failing to make calculations of his own. It appears rather extraordinary that an expert should fail to make a calculation because of alleged failure of another to make one for him. Would he have accepted the figures of another as his own conclusion? Verily, we would ask, what manner of expert is this? Mr. Terry has dealt in detail with this notable effusion, hence it will not be necessary for us to do so. We will, however, call your attention to some of its main features, especially the general tenor and the conclusion sought to be made in favor of building an iron truss bridge instead of the design submitted. This feature is too indicative of the reasons within him to need comment.

We do not credit Mr. Collingwoo when he makes the remarkable statement contained in the conclusion of his second article, viz: that he would hardly know how to estimate the strains in this proposed bridge. The rules governing calculations of strength of cables, towers, floors, foundations, anchorage, etc., are the same always under like conditions, and in these essentials this bridge is similar to any other suspension bridge of the usual types. The addition of the wind brace cables, and of the auxiliary device for stiffening and staying the bridge, does not alter the rules governing the strength of other members, unless it be to strengthen them.

We think, and the opinion is justified by his course, that Mr. Collingwood had some ulterior purpose to serve, and that all that deterred him from attacking the vital features of the structure was the lack of audacity to attempt it in the face of his profession. The only part of the entire structure which he attempts to attack for lack of strength is the single exception of the brace rods to the hand-rail.

The sum and gist of this remarkable expert production is advice to build an iron bridge, which might, and indeed had been, as urgently given by the avowed representatives of that kind cf bridge without charge. Who was his unnamed friend to whom he submitted the plans, and whose opinion he gives us second-hand?

Now we will ask your honorable body to compare our proposed bridge, to be supported by 2147 No. 9 galvanized steel wires (leaving out of account the lower half of the auxiliaries), with the well-known Waco bridge, which is supported by about 1550 wires of the same size. The Waco bridge is about 500 feet long, and though poorly stayed, has stood severe tests of traffic and storm for some twenty-three years, and was pronounced on inspection about two years ago to be perfectly sound. It was about that time sold to the county for $75,000, and Dr. Eddy, while in Waco a few days subsequent, offered to duplicate it as to size, and to give nearly double guaranteed strength, for the sume of $35,000, and was ready to give sufficient bond for fulfillment of the offer. We desire to build an unquestionably good bridge for the city, and in this connection will say that Dr. Eddy is now on his way to this city, and we would prefer to have him go over our plans before we begin work, and if he and his engineers think any additions should be made, we will cheerfully make them. We are, however, firm in the opinion that our plans are more than sufficient, and will make the best bridge ever built in the county. We are respectfully, NEIL P. ANDERSON, & Co.,
For T. J. Matlock.

Specifications for an Eddy steel wire suspension bride over Trinity river at Fort Worth, Texas.

The total length of the bridge is to be 230 feet, consisting of 200 feet of suspended span between the towers and fifteen feet of an approach at each end. The total width of the bridge is to be forty-two feet from out to out, consisting of two roadways of sixteen feet each, and two sidewalks of five feet each.

The bridge is designed to carry a load of 100 pounds to each square foot of clear available platform space on roadways, and sixty pounds for each square foot of clear available space on sidewalks, allowing a safety factor of five wires. The wire designed for the cables, hangers and stays is to be No. 9 Birmingham gauge, galvanized steel wires, and of an ultimate tensile strength of 165,000 pounds per square inch net section of metal, allowing fifty-eight of such wires to equal one square inch of metal area.

The anchorage is made with side and cross trenches with anchor pipe laid from side to side behind a mass of piling and concrete as shown on plan. This mass will be carried down to a depth of about sixteen feet below the surface of the ground where the earth is compact and unyielding.

The anchor pipe will be a six-inch wrought iron pipe filled with concrete inside and entirely surrounded by concrete when the anchorage is completed sons to be protected from rust and decay. All cables and stays are to be surrounded by concrete wherever penetrating the earth.

Cables—The cables are arranged as shown on the plan. There are three main cables assisted by six auxiliary cables. The number of wires in each of the cables shall be as follows:

	No. wires	Tot'l No. wires.
Main center cable	825	825
Two auxiliary center cables	133	266
Two main side cables	520	1,040
Four side auxiliary cables	100	400
Nine cables of a grand total	..	2,531

The main cables all pass from the anchor at one end over the towers to the anchor at the other end. The auxiliary cables pass from one anchor through the base of the tower. Thence across the river, passing over the opposite tower to the other anchor. These auxiliary cables cross each other at the center of the span, where they are wrapped firmly together, forming a truss, giving the bridge great rigidity and strength at its center. These cables are composed of parallel wires extending from end to end, and when splicing is necessary it is made by serving one end back upon itself as in the telegraph wire splice. The cables when finished will be wrapped at intervals of every two feet between panels for say a distance equal to the diameter of the cable, or by wrapping the entire distance between the panels with an individual wire drawn firmly around the cable with a space of that equal to the diameter of the cable apart, the wrapping wire in no case to be larger than Nos. 12 or 14. The suspenders will loop twice over the cables above, and will pass down between the girders and engage the lower cable with a loop. They will be placed every ten feet on each side of the bridge and in the center as shown in the plans, and shall consist of the following sizes:

Suspenders for center main cable, 30 wires each.

Suspenders for center auxiliary cable, 10 wires each.

Suspenders for side main cable, 20 wires each.

Suspenders for side auxiliary cable, 8 wires each.

All stays, hangers and diagonals will be wrapped into compact cables between their points of attachment by separate wire wound spirally around them, so that the wrapping wire shall lay about the diameter of the cable apart from itself.

A hub board consisting of a 2x10 pine fender placed on each side of the driveway and made fast to the hangers and diagonals shall be put in the bridge. The digonals are wire cables of ten wires each extending from one end of the bridge to the other as shown on the plans. They engage the top cable by being passed over one side and down on the opposite side of the cable at each panel. They are them firmly secured at the joints by wrapping the sides together under the cable. The lower joints are made by passing the diagonal cable down the side of the stringer across underneath the lower cable and up against the other side of the stringer to the top cable at the next successive joint as shown by the plans. These diagonals distribute the loads and help to stiffen the bridge against undulations.

Stays.—There shall be eighteen stays in all, as follows:

	Total.
4 outside stays of 100 wires each	400
2 center stays of 120 wires each	240
2 center stays of 60 wires each	120
4 outside stays of 50 wires each	200
4 outside stays of 20 wires each	80
2 center stays of 30 wires each	60

Total number of wires in all the stays..1100

They are designed to pass from separate anchorages over the towers as shown on the plans to the points of attachment with lower cable at the distances of ten, thirty and fifty feet from the towers.

The girders as indicated on the plans are timbers 5x16 placed in pairs at each hanger and extending from side to side of the bridge. They lap at the center lower cable where they are spiked together. These carry the floor beams which are laid across them as shown on plans.

The floor-beams are 2x16x20 feet long, extending from end to end of the bridge two feet apart as shown on the plans. Each joist reaching over and resting upon three stringers so as to abut on alternate stringers which gives greater rigidity to the floor system. Across these timbers the floor is laid on the bias as shown in the plans.

Flooring—The flooring for the roadways shall be of good ordinary pine lumber, free from injurious knots and windshakes, three inches thick and of sufficient length to lay on the bias as shown on plans, to be well nailed to the floor-beams. The flooring for sidewalks shall be the same except that it shall be two inches thick, and shall be laid down as shown on plans. The girders, floor-beams, chords and posts of the hand-rail shall be of first-class long leaf pine, free from injurious knots, windshakes and other defects.

All lumber and timbers shall be well fitted together so as to present a finished and workmanlike appearance when the structure is completed.

The hand rail is composed of a top and a lower chord of a 4x4 piece each with a wooden post 4x4x3½, placed every five feet with a plank 2x8 nailed between as shown on plans. The diagonal round iron rods between the panels will be ⅝ inch in diameter and will have cast fittings at the top joints. The flooring will extend out eighteen inchs at each panel to support a ⅝ inch brace rod to stiffen said hand rail.

Foundations—They will rest upon a bed of concrete as shown on plans. The masonry must be laid in courses as shown with cemented joints and battered sides as shown, in a neat manner, except that the portion below the surface may present rough outer faces. The retaining walls will be constructed as shown, of dry masonry and pointed well between outer joints with cement mortar. The outer surface to be battered, as shown on plans.

Towers—The towers are made of rolled steel, lapped and well riveted ⅜ inch in thickness and of the length and dimensions shown on plans. When in place they are to be filled with concrete to prevent sweating and rust inside. The towers will rest on circular cast-iron bed-plates, the center one three and one-half feet and the outer ones three feet in diameter. The thickness at the center will be two inches, tapering to one-half inch at the edge and being provided with stiffening ribs extending from the center to the sides. The towers will be well braced at the top with a portal as indicated on plans, except, perhaps, the lower angle irons will need to be placed a foot higher up so as to give more space for high loads to pass under.

Lateral brace cables of thirty No. 9 galvanized steel wires will be placed as exhibited on the plans, except that they are to pass in a continuous cable around the towers in a figure of eight styles, instead of being fastened to collars at the bases of the towers as shown, crossing on the bridge as shown on the plans. This will secure them to the bases of the towers with certainty. These lateral wind cables are laid in slots at the top surface of the girders, preventing side motion of all parts of the bridge.

The cables rest at the top of the towers in a grooved cast fitting so as to hold them in position and transmit the strains evenly upon the shell of each tower.

The cement mortar for the piers shall be made as follows: One measure of Portland cement to two measures of clean sharp sand mixed dry, and only water enough added to form a thick paste. All mortar must be made fresh when used.

Concrete—The concrete for anchorages and foundations is to be made from Louisville cement and shall be made as follows: To one measure of cement add two measures of sand well mixed dry. To this add four parts of coarse gravel or broken rock, or if rock shall be placed in the interstices between the piling; grouting composed of the same proportion of cement and sand, may be made to fill between the rock and around the piling. Louisville cement is preferable to Portland about the anchorages, as it does not set so rapidly as the former. Too rapid setting is objectionable on account of the liability to crack on account of vibrations in cables during construction.

All iron work and the hand rail is to be well painted with two coats of good paint, also the cables if desired.

All work herein specified for to be executed in a neat, thorough and workmanlike manner, and the bridge when completed shall present a finished appearance.

These specifications are to govern where there exist any differences between them and the accompanying plans, provided such differences shall not work to the detriment of the structure.

The specifications are so extended as to include the attached report of the engineering firm of Johnson & Flad of St. Louis made on the plans of the proposed bridge for Neil P. Anderson & Co., who are interested in this undertaking, and are made a part hereof.

ST. LOUIS, Oct. 29, 1891.

Messrs. Neil P. Anderson & Co., Fort Worth, Tex.

GENTLEMEN—In accordance with your instructions of the 15th inst. we have examined the plans and specifications of the proposed suspension bridge over Trinity river at your city, and beg leave to submit the following report:

1. Assumed loads—The live loads which have been assumed for this bridge are excessive. It is practically impossible to get a live load of 100 pounds per square foot on any bridge. The greatest load which can be put upon a bridge is a crowd of people, solidly jammed together, and then about eighty pounds per square foot is all that can be put on. In northern countries a snow load of some thirty to forty pounds per square foot is allowed for, but this is not necessary in your latitude. To require a factor of safety of five, therefore, with this excessive load is making the structure unnecessarily expensive. A factor of four with these loads would be ample.

The cables—Taking the loads and dimensions specified we find that the center cables carry a total load of 382,000 pounds, and each pair of side cables 271,000 pounds. Now there are two cables to carry each of these loads, a main cable with a sag of twenty feet and an auxiliary cable with a sag of twenty-five feet. Furthermore, the main cables are designed to be aoout five and one-half times as large as the auxiliaries. In such a case the load will divide itself between the cables in proportion to their size and to the squares of their sags. Thus the load on the main is to the load on the auxiliary as 5⅛x20x20 is to 1x25x25, or as 2200 is to 625. That is to say, seven-ninths of the load will go on the main and two-ninths on the auxiliary cables. Hence we will have the following loads, stresses and sizes, allowing a working stress of 33,000 pounds per square inch in the wires, and taking fifty-eight No. 9 wires to the square inch of solid metal:

CABLE.	Load.	Stress at towers.	Area required.	Number of wires.	Totals.
Main center	297,000	405,000	12.2	712	712
Main side	211,000	288,000	8.75	507	1014
Aux. center	85,000	94,500	2.57	163	163
Aux. side	60,000	66,600	2.03	118	236
Total					2225

The plan shows a total of 2147 wires, or but seventy-eight less than here found. That is to say, the cables have very nearly a factor of safety of five when the whole load is properly divided between them, and when no load is supposed to be carried by the stays.

The stays.—A part of the live or dead load is always carried by the stays, when the bridge is fully loaded. They also serve to prevent distortion when the bridge is loaded unsymmetrically. The stays which extend farthest from the piers should be larger than those attached to a steeper angle, whereas those shown are all the same size. In the design submitted, which has no stiffening truss, the only means of preventing distortion from unsymmetrical loads, are the stays and the diagonal wire bracing. The effect of these braces can hardly be computed, and since we have never seen a bridge in which they were employed, we cannot offer an opinion on the degree of stiffness they will furnish. That it will be considerable cannot be denied, but we cannot say how much. Therefore we cannot predict just how much of the unsymmetrical load will have to be carried by the stays. We would recommend, however, that the second and third stays from the tower be increased to say fifty to 100 wires respectively on the outside, and to sixty and 120 wires respectively at the center.

The towers.—The vertical load on each side tower is 271,000 pounds, and on the middle towers, 382,000 pounds. We think all this should be transmitted through the steel plates, which with a factor of safety of six, would require one-half inch metal in all towers, with the diameters given, in place of three-eighth inch, as given on the plans. These should also be made of single plates, rolled into a cylinder, so as to dispense with horizonal abutting joints.

The wind bracing.—The total wind pressure allowed for should be about thirty pounds per square foot, and for the construction shown, thirty No. 9 steel wires would stay it against this load, but we think they should be laid in a curve, in slots in all floor beams, so as to pull equally on all, instead of only on the center beam as shown. We have indicated the proper arrangement on our drawing. The towers should also be stayed by a stronger system of wind bracing than shown on the drawings. The towers are so small that they have not a great deal of stability on their bases. We have shown such bracing on our plan.

The piers.—If the piers be made of good masonry, laid in Portland cement mortar, and the steel towers rest on castiron caps floated to place on Portland cement mortar, the resistance to crushing immediately below the towers will be ample. For the maximum load, a casting of but three feet in diameter under the center column, and one two and a half feet in diameter under the side columns, would give a crushing load of but 400 pounds per square inch, which gives a factor of safety here of at least five or six. With larger castings the pressure would be correspondingly less. The two or three top courses of stones, however, should be well-fitted, squared stones of uniform depth of course, with thin and well-fitted joints, with a good capstone, so as to allow of an even distribution of pressure and of settlement over the whole area of piers.

The anchorages.—Either system of anchorage proposed is satisfactory, if made of sufficient size. If concrete be used, we estimate that a mass of concrete, made of natural or Louisville cement, eight feet high, six feet wide and forty feet long, with eight feet of earth over its surface will have, by its own weight and the resistance of the earth in front of and above it, about twice the resistance of the maximum pull on all the cables when the bridge is fully loaded, which it is quite impossible for it ever to be. If piles are used in addition as shown on our plans, the resistance will be immensely increased. We would not fear that these piles would decay under the concrete, even though above the line of low water. They would certainly last a hundred years or more in such a place, if the air cannot circulate about them. We have known of similar instances where, after fifty years, they seemed to be as sound as ever. But in this case the stability of the anchorage would not depend upon the piles, but upon the dead weight of the concrete and the ground resistance in front.

Floor system.—The floor system designed is amply strong to carry the proposed loads, but it would have great flexibility, and the only reliance against an unequal distortion would be in the diagonal wire bracing. We think this would probably not be satisfactory, and hence we take the liberty of suggesting the following:

Proposed changes of plans.—In order to obtain greater stiffness against unsymmetrical loads, as well as to avoid undulations from the wind, we think it would be well to change the plans in the following particulars:

1. Reduce the sag of both cables, that of the main cable to fifteen feet, and of the auxiliary cable to twenty-two feet. This, in itself, would add greatly to the stiffness of the bridge. If the stays be increased in size as indicated above, and if they be estimated to carry their due proportion of the total live loads which they must do of necessity, then we find the size of the main and auxiliary cables to be as follows:

	Wires.	Wires in all.
Main center cable	825	825
Auxiliary center cable	133	133
Main side cables	520	1,040
Auxiliary side cables	100	200
Total		2198

Since the auxiliary cables are doubled, this total must be increased by 333 wires, making in all 2531 wires passing from one anchorage to the other. This is with the loads named in the specifications, and a factor of safety of 5. All wires No. 9, Birmingham gauge of 165,000 pounds per square inch ultimate strength.

2. To further add to the stiffness of the floor system, it would be well to change its construction by using two 5x16-inch floor beams at each hanger, say ten feet apart, and across these lay, lengthwise of the bridge, floor joists 2x16 inches and twenty feet long, so as to overlap, alternate joists being spliced on successive beams. These joists might be laid twenty-four inches C. to C. The floor plank should then be laid diagonally as shown on the plans, to assist in stiffening the bridge against wind pressure, and the floor joists should also be well bridged, as is also shown in the design submitted.

A further advantage of this arrangement is that the floor system is more directly suspended from the cables than in the original plans.

The stays, in this case, would be attached to the auxiliary cable at the 10, 30 and 50 foot distances from the tower, where the floor beams rest and the hangers are attached. These sizes might be the same as given above, viz: 20, 50 and 100 wires on the sides and 30, 60 and 120 wires in the center.

We have made a drawing showing a general plan and elevation of the structure on this basis, and submit it for your consideration. If it is not too late to modify the design we think these changes would add greatly to the satisfactory operation of the bridge. When a stiffening truss is omitted every precaution should be taken to supply its place as nearly as possible in the construction of the other parts. The light, trussed, hand-rail shown in the plans does not serve to stiffen this bridge to any material degree, but the diagonal tie rods should be increased to ⅝-inch if screw threads are to be cut on them. With this floor system as here described, and with the diagonal wire guys and wire stays as shown on our drawing, and with the diminished sags of cables herein specified, we believe the bridge would be very rigid under all ordinary conditions of traffic, and would be abundantly strong for even the excessive loading assumed in the specifications.

Of course it is assumed that the details of construction will be carefully worked out, many of which are not shown on the drawings submitted, and that the work will be done by intelligent and competent parties, familiar with this kind of construction.

It is, we believe, perfectly practicable to protect and preserve the cables, by the methods indicated, if it is properly done.

As to the foundations of the towers, they are evidently sufficient as shown, if protected from caving off into the river, which, we presume, there is no danger of their doing. If such a fate should at any time become imminent, it should not be difficult to slope off and rip-rap the bank, or protect by piling and cribwork, and so save the foundations.

We believe we have now answered fully all the inquiries you have put us, but if not will you please make such further demands upon us as will enable us to fully meet the exigencies of the case. Very respectfully yours,

JOHNSON & FLAD,
Consultin- Engineers.

Notice of Sale.

The Fort Worth and Denver City Railway Company will sell at its freight depot at Fort Worth, Tex., on Tuesday, November 10, 1891, at two (2) o'clock p. m., at public auction to the highest bidder, the following described property, to-wit:

Two carloads of bulk potatoes [illegible] Rising, Neb., consigned to T. [illegible], Fort Worth, Tex., in car [illegible] Co., 4449 containing [illegible] and thirty-eight (638) [illegible] more or less, and car D. & R. G. 11,085, containing eight hundred and sixty-four (864) bushels, more or less.

Said property being perishable and in danger of depreciation, and being refused by consignee, will be sold to satisfy freight and demurrage charges thereon.

Dated at Fort Worth, Tex., this the 4th day of November, 1891. W. F. STERLEY, Agent Fort Worth and Denver City Railway Company.

Sale of Unclaimed Express Matter.

Wells, Fargo & Co.'s express sale of unclaimed goods will take place on Saturday, November 7, at 110 Main street, commencing at 10 o'clock a. m.

AN OCCULT POWER.

Wonderful Predictions of a Young Girl in Iowa—Her Prophesies Fulfilled.

Special to the Gazette.

HAMBURG, IOWA, Nov. 6.—There is a girl in this neighborhood whose wonderful predictions and their verifications are the talk of the whole county. The girl is Laura Speed, and she is but fourteen years old. She first showed her power about a year ago when she came down to breakfast and said that Mrs. Jones was going to die before night.

Mrs. Jones was a neighbor who lived half a mile from the Speeds. She was in good health the day before, and when the girl was asked why she said such things she said she did not know but that something said so to her. That day Mrs. Jones was killed in a runaway accident. This caused much talk and the girl said she could not account for what she said as she was awake at the time when it seemed as if something said in her ear that Mrs. Jones would die. From that time to the present Laura has made several predictions and each one has come to pass. Her most pronounced prediction was made on the 15th of last September, when she said that many children would die soon. Within a week malignant diptheria broke out and became so virulent that the schools were closed. Within two weeks of the prediction seven children had died in the town and neighboring country.

On the morning before the recent earthquake she said, "We are going to get a shaking up." She could not explain what she mean, but said that was what she had been told. That night the earthquake fulfilled her prophesy. Her latest prediction is one which has caused much uneasiness among those who have heard of her former sayings and have noted their truth, for she says that much trouble is coming to everybody living in this part of the country. She does not know what the trouble is or when it will come, but says that it will be soon. The girl is a perfectly healthy child, and is in no way given to hysteria. She says she is always awake when she receives the information, and it is just as if some one spoke it in her ear.

Sale of Unclaimed Express Matter.

Wells, Fargo & Co.'s express sale of unclaimed goods will [illegible] November [illegible] street, commencing at 10 o'clock a. m.

Another of the Katy Victims Identified.

Special to the Gazette.

TEMPLE, BELL COUNTY, TEX., Nov. 6.—The negro boy who was killed in the collision of the Missouri, Kansas and Texas, north of this city on Wednesday morning, has been identified as Gertrude Winford, the thirteen-year-old son of John Winford, a colored man who resides at Taylor, Tex. Several cars were so badly wrecked that they were burned on the ground and the irons only were saved.

Sale of Unclaimed Express Matter.

Wells, Fargo & Co.'s [illegible] of unclaimed [illegible] take place on Saturday, November 7, at 110 Main street, commencing at 10 o'clock a. m.

The Colorado in Port.

Special to the Gazette.

GALVESTON, TEX., Nov. 6.—Arrived—Steamship Colorado, from New York, with general merchandise.

Sale of Unclaimed Express Matter.

Wells, Fargo & Co.'s [illegible] of unclaimed [illegible] will take place on Saturday, November 7, at 110 Main street, commencing at 10 o'clock a. m.